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FAIRCHILD SEMICONDUCTOR™

October 1987
Revised January 1999

# CD4070BC
# Quad 2-Input EXCLUSIVE-OR Gate

## General Description

The CD4070BC employs complementary MOS (CMOS) transistors to achieve wide power supply operating range, low power consumption, and high noise margin, the CD4070BC provide basic functions used in the implementation of digital integrated circuit systems. The N- and P-channel enhancement mode transistors provide a symmetrical circuit with output swing essentially equal to the supply voltage. No DC power other than that caused by leakage current is consumed during static condition. All inputs are protected from damage due to static discharge by diode clamps to $V_{DD}$ and $V_{SS}$.

## Features

- Wide supply voltage range: 3.0V to 15V
- High noise immunity: 0.45 $V_{DD}$ typ.
- Low power TTL compatibility:
  Fan out of 2 driving 74L or 1 driving 74LS
- Pin compatible to CD4030A
  Equivalent to MM74C86 and MC14070B

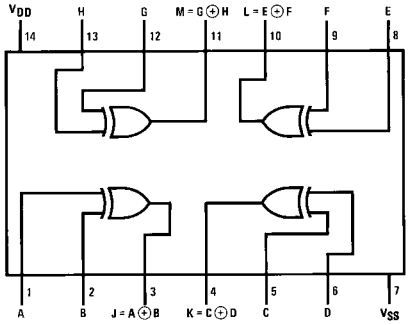
## Ordering Code:

| Order Number | Package Number | Package Description |
|---|---|---|
| CD4070BCM | M14A | 14-Lead Small Outline Integrated Circuit (SOIC), JEDEC MS-120, 0.150" Narrow Body |
| CD4070BCN | N14A | 14-Lead Plastic Dual-In-Line Package (PDIP), JEDEC MS-001, 0.300" Wide |

Devices also available in Tape and Reel. Specify by appending the suffix letter "X" to the ordering code.

## Connection Diagram

**Pin Assignments for SOIC and DIP**




**Top View**

## Truth Table

| Inputs | | Outputs |
|---|---|---|
| A | B | Y |
| L | L | L |
| L | H | H |
| H | L | H |
| H | H | L |

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## Absolute Maximum Ratings (Note 1)

(Note 2)

| | |
|---|---|
| DC Supply Voltage ($V_{DD}$) | −0.5 to +18 $V_{DC}$ |
| Input Voltage ($V_{IN}$) | −0.5 to $V_{DD}$ +0.5 $V_{DC}$ |
| Storage Temperature Range ($T_S$) | −65°C to +150°C |
| Power Dissipation ($P_D$) | |
| Dual-In-Line | 700 mW |
| Small Outline | 500 mW |
| Lead Temperature ($T_L$) | |
| (Soldering, 10 seconds) | 260°C |

## Recommended Operating Conditions (Note 2)

| | |
|---|---|
| DC Supply Voltage ($V_{DD}$) | 3V to 15 $V_{DC}$ |
| Input Voltage ($V_{IN}$) | 0 to $V_{DD}$ $V_{DC}$ |
| Operating Temperature Range ($T_A$) | −40°C to +85°C |

**Note 1:** "Absolute Maximum Ratings" are those values beyond which the safety of the device cannot be guaranteed. They are not meant to imply that the devices should be operated at these limits. The table of "Recommended Operating Conditions" and "Electrical Characteristics" provides conditions for actual device operation.

**Note 2:** $V_{SS}$ = 0V unless otherwise specified.

## DC Electrical Characteristics (Note 3)

| Symbol | Parameter | Conditions | −40°C | | +25°C | | | +85°C | | Units |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | Min | Max | Min | Typ | Max | Min | Max | |
| $I_{DD}$ | Quiescent Device Current | $V_{DD}$ = 5V, $V_{IN}$ = $V_{DD}$ or $V_{SS}$ | | 1.0 | | | 1.0 | | 7.5 | µA |
| | | $V_{DD}$ = 10V, $V_{IN}$ = $V_{DD}$ or $V_{SS}$ | | 2.0 | | | 2.0 | | 15 | µA |
| | | $V_{DD}$ = 15V, $V_{IN}$ = $V_{DD}$ or $V_{SS}$ | | 4.0 | | | 4.0 | | 30 | µA |
| $V_{OL}$ | LOW Level Output Voltage | $\|I_O\|$ < 1 µA | | | | | | | | |
| | | $V_{DD}$ = 5V | | 0.05 | | 0 | 0.05 | | 0.05 | V |
| | | $V_{DD}$ = 10V | | 0.05 | | 0 | 0.05 | | 0.05 | V |
| | | $V_{DD}$ = 15V | | 0.05 | | 0 | 0.05 | | 0.05 | V |
| $V_{OH}$ | HIGH Level Output Voltage | $\|I_O\|$ < 1 µA | | | | | | | | |
| | | $V_{DD}$ = 5V | 4.95 | | 4.95 | 5 | | 4.95 | | V |
| | | $V_{DD}$ = 10V | 9.95 | | 9.95 | 10 | | 9.95 | | V |
| | | $V_{DD}$ = 15V | 14.95 | | 14.95 | 15 | | 14.95 | | V |
| $V_{IL}$ | LOW Level Input Voltage | $\|I_O\|$ < 1 µA | | | | | | | | |
| | | $V_{DD}$ = 5V, $V_O$ = 4.5V or 0.5V | | 1.5 | | | 1.5 | | 1.5 | V |
| | | $V_{DD}$ = 10V, $V_O$ = 9V or 1.0V | | 3.0 | | | 3.0 | | 3.0 | V |
| | | $V_{DD}$ = 15V, $V_O$ = 13.5V or 1.5V | | 4.0 | | | 4.0 | | 4.0 | V |
| $V_{IH}$ | HIGH Level Input Voltage | $\|I_O\|$ < 1 µA | | | | | | | | |
| | | $V_{DD}$ = 5V, $V_O$ = 0.5V or 4.5V | 3.5 | | 3.5 | | | 3.5 | | V |
| | | $V_{DD}$ = 10V, $V_O$ = 1V or 9.0V | 7.0 | | 7.0 | | | 7.0 | | V |
| | | $V_{DD}$ = 15V, $V_O$ = 1.5V or 13.5V | 11.0 | | 11.0 | | | 11.0 | | V |
| $I_{OL}$ | LOW Level Output Current | $V_{DD}$ = 5V, $V_O$ = 0.4V | 0.52 | | 0.44 | 0.88 | | 0.36 | | mA |
| | | $V_{DD}$ = 10V, $V_O$ = 0.5V | 1.3 | | 1.1 | 2.25 | | 0.9 | | mA |
| | | $V_{DD}$ = 15V, $V_O$ = 1.5V | 3.6 | | 3.0 | 8.8 | | 2.4 | | mA |
| $I_{OH}$ | HIGH Level Output Current | $V_{DD}$ = 5V, $V_O$ = 4.6V | −0.52 | | −0.44 | −0.88 | | −0.36 | | mA |
| | | $V_{DD}$ = 10V, $V_O$ = 9.5V | −1.3 | | −1.1 | −2.25 | | −0.9 | | mA |
| | | $V_{DD}$ = 15V, $V_O$ = 13.5V | −3.6 | | −3.0 | −8.8 | | −2.4 | | mA |
| $I_{IN}$ | Input Current | $V_{DD}$ = 15V, $V_{IN}$ = 0V | | −0.3 | | $-10^{-5}$ | −0.3 | | −1.0 | µA |
| | | $V_{DD}$ = 15V, $V_{IN}$ = 15V | | 0.3 | | $10^{-5}$ | 0.3 | | 1.0 | µA |

**Note 3:** "Absolute Maximum Ratings" are those values beyond which the safety of the device cannot be guaranteed. They are not meant to imply that the devices should be operated at these limits. The table of "Recommended Operating Conditions" and "Electrical Characteristics" provides conditions for actual device operation.

## AC Electrical Characteristics (Note 4)

$T_A = 25°C$, $C_L = 50$ pF, $R_L = 200$k, $t_r$ and $t_f \leq 20$ ns, unless otherwise specified

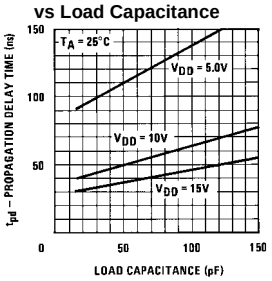
| Symbol | Parameter | Conditions | Min | Typ | Max | Units |
|---|---|---|---|---|---|---|
| $t_{PHL}$ or | Propagation Delay Time | $V_{DD} = 5V$ | | 110 | 185 | ns |
| $t_{PLH}$ | from Input to Output | $V_{DD} = 10V$ | | 50 | 90 | ns |
| | | $V_{DD} = 15V$ | | 40 | 75 | ns |
| $t_{THL}$ or | Transition Time | $V_{DD} = 5V$ | | 100 | 200 | ns |
| $t_{TLH}$ | | $V_{DD} = 10V$ | | 50 | 100 | ns |
| | | $V_{DD} = 15V$ | | 40 | 80 | ns |
| $C_{IN}$ | Average Input Capacitance | Any Input | | 5 | 7.5 | pF |
| $C_{PD}$ | Power Dissipation Capacitance | Any Input (Note 5) | | 20 | | pF |

**Note 4:** AC Parameters are guaranteed by DC correlated testing.

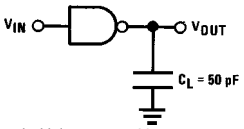
**Note 5:** $C_{PD}$ determines the no load AC power consumption of any CMOS device. For complete explanation, see 74C Family Characteristics Application Note—AN-90.

## Typical PerformanceCharacteristics

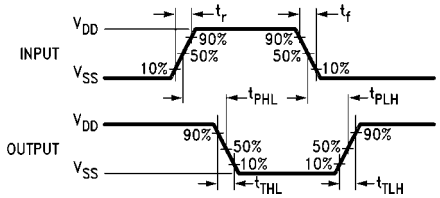
**Propagation Delay Time vs Load Capacitance**




## AC Test Circuit and Switching Time Waveforms

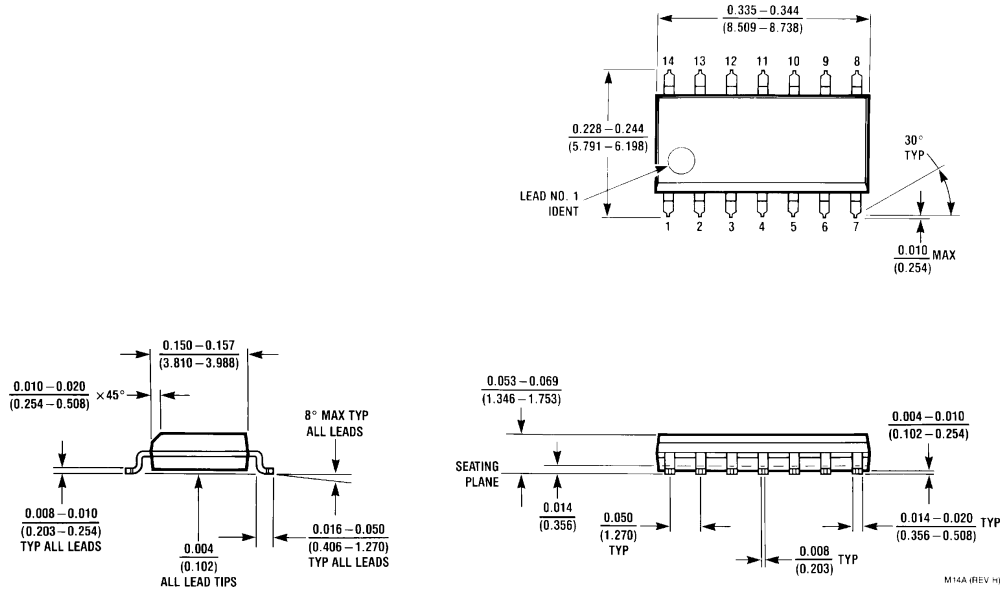



**Note:** Delays measured with input $t_r$, $t_f = 20$ ns.



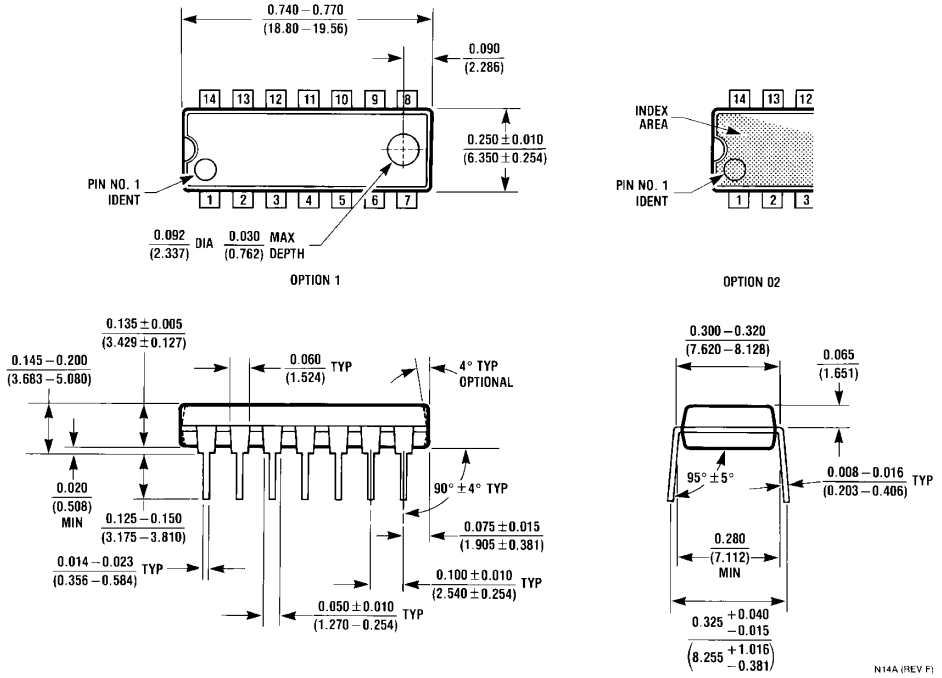

$t_r = t_f = 20$ ns

## Physical Dimensions inches (millimeters) unless otherwise noted




**14-Lead Small Outline Integrated Circuit (SOIC), JEDEC MS-120, 0.150” Narrow Body**
**Package Number M14A**

## Physical Dimensions inches (millimeters) unless otherwise noted (Continued)




**14-Lead Plastic Dual-In-Package (PDIP), JEDEC MS-001, 0.300" Wide**
**Package Number N14A**

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